
Through-penetration Firestop Systems

[Guide Information for Fire Resistance Ratings](#)

GENERAL

This category covers firestop systems, which are specific constructions consisting of a wall or floor assembly, a penetrating item passing through an opening in the wall or floor assembly, and the materials designed to prevent the spread of fire through the openings. The specifications for materials in a firestop system and the assembly of the materials are details that directly relate to the established ratings. Information concerning these details is described in the individual systems. The hourly ratings apply only to the complete systems. Individual components are designated for use in a specific system to achieve specified ratings. The individual components are not assigned ratings and are not intended to be interchanged between systems. Additionally, the substitution or elimination of components required in a system should not be made unless specifically permitted in the individual system or in these general guidelines.

The firestop systems covered under this category have been investigated with a positive furnace pressure differential of at least 0.01 in. of water maintained at a distance of 12 in. below horizontal test assemblies and 0.78 in. below the fill materials surrounding the penetrating items passing through vertical test assemblies. The Classifications of firestop systems contemplate installation in heated and air conditioned environments unless stated otherwise in the description of the system.

[ANSI/UL 1479](#), "Fire Tests of Through-Penetration Firestops," defines the criteria for hourly F, T, L and W ratings for firestop systems. The F-rating criteria prohibits flame passage through the system and requires acceptable hose-stream test performance. The T-rating criteria prohibits flame passage through the system and requires the maximum temperature rise on the unexposed surface of the wall or floor assembly, on the penetrating item and on the fill material not to exceed 325°F (181°C) above ambient, and requires acceptable hose-stream test performance.

The L-rating criteria determines the amount of air leakage, in cu feet per minute per square foot of opening (CFM/sq ft) or in cu feet per minute per unit (CFM/unit) for fixed-size opening units, through the firestop system at ambient and/or 400°F air temperatures at an air-pressure differential of 0.30 in. W.C. The L ratings are intended to assist Authorities Having Jurisdiction and others in determining the suitability of firestop systems for the protection of penetrations and miscellaneous openings in floors and smoke barriers for the purpose of restricting the movement of smoke in accordance with ANSI/NFPA 101, "Life Safety Code."

The Class 1 W rating determines the capability of the firestop system to maintain watertightness of the penetration through a floor or wall construction at ambient air conditions under 3 ft of water pressure head (1.3 psi) for a period of 72 hours. The W rating may be applicable for building structures whose floors are subjected to incidental standing water and/or for buildings that house critical equipment as described in ANSI/NFPA 75, "Fire Protection of Information Technology Equipment," and ANSI/NFPA 76, "Fire Protection of Telecommunications Facilities."

Acceptance is based upon the ability of the firestop system to withstand the applied pressure without the passage of any water through the firestop system. After the Class 1 watertightness test, the firestop system is conditioned in accordance with the requirements of [ANSI/UL 1479](#) and the fire and hose stream tests described in the standard are conducted.

The W rating is intended to assist Authorities Having Jurisdiction and others in determining the suitability of firestop systems in applications where submersion in water may be a factor.

Materials used in the firestop systems are intended to be installed in accordance with the manufacturer's instructions provided with the materials. The structural integrity of the floor or wall assembly needs to be investigated when providing openings for the penetrating items. The fill, void or cavity material thickness published in the fire-resistance designs is measured wet and may be susceptible to a percentage of shrinkage during the curing process. Firestop systems are investigated after the fill, void or cavity materials are fully cured. Refer to the individual Classifications under Fill, Void or Cavity Materials ([XHHW](#)) for the investigated percentage of shrinkage.

The minimum and/or maximum annular space referenced in the firestop system must be maintained in order to achieve the hourly rating of the system. The annular space of a penetrating item through a rectangular opening is determined by measuring the distance from the closest point of the penetrating item to a point perpendicular to each of the four sides of the opening. The diagonal dimension is not intended to represent the annular space of a rectangular opening. The annular space between multiple penetrating items within a rectangular opening is determined by measuring the closest point of one penetrating item to the closest point of the adjacent penetrating item.

ANSI/NFPA 90A, "Installation of Air-Conditioning and Ventilating Systems," contains requirements on the use of fire dampers in conjunction with ventilation ducts. Unless specifically indicated as part of the Classification of the damper, the annular space around the damper sleeve should not be firestopped with the materials described herein.

The systems covered under this category are Classified with respect to (1) installation in a wall only, (2) installation in a floor only or (3) installation in either a wall or a floor. Unless otherwise indicated in the systems, the ratings for firestop systems installed in walls apply when either face of the wall is exposed to fire. The ratings for firestop systems installed in a floor apply when the underside or ceiling surface is exposed to fire.

The hourly fire-endurance rating of the walls and floors incorporating these systems are not indicated. Volume 1 of the Fire Resistance Directory covers the hourly fire-endurance ratings of floor and wall assemblies. Firestop systems that specify installation in concrete floors may include installation in floors consisting of fluted or corrugated steel deck topped with structural concrete, provided that (1) the concrete topping thickness measured above the top plane of the steel deck is equal to or greater than the minimum concrete thickness specified in the system, and (2) the firestop system does not require any portion of the forming material or fill material to extend below the bottom plane of the floor.

Some firestop systems specify the use of hollow-core precast concrete unit floor assemblies. Where not specified, firestop systems utilizing caulk, sealant, putty or spray materials installed over a mineral wool or ceramic blanket may be installed in hollow-core floors, provided that (1) the thickness of the hollow-core floor is equal to or greater than the minimum concrete thickness specified in the system, (2) the maximum size of the opening is 7 in. diameter or 7 in. by 7 in., and (3) any cores of the precast concrete units penetrated as a result of the firestop system are sealed with a minimum 4 in. depth of either firmly packed minimum 4 pcf mineral wool or ceramic fiber blanket, or concrete, grout or mortar. Additionally, firestop systems utilizing a firestop device or wrap strips/steel collar installed around the penetrant beneath the floor may be installed in hollow-core floors, provided that (1) the thickness of the hollow-core floor is equal to or greater than the minimum concrete thickness specified in the system, and (2) the maximum size of the opening is 7 in. diameter or 7 in. by 7 in.

ANSI/NFPA 70, "National Electrical Code" (NEC), contains requirements for permissible installation and percentages of electrical conductor fill for conduit, cable trays and other electrical conductor raceways.

Authorities Having Jurisdiction should be consulted as to the particular requirements covering the installation and use of these Classified systems.

PENETRATING ITEMS

When the penetrating item is indicated as being conduit, the conduit is intended for use as a raceway for electrical conductors in accordance with the NEC. Electrical conductors may be used without conduit only when permitted by and installed in accordance with the NEC, and when the conductors are specifically described in the firestop system. The maximum conductor size and the maximum number of conductors in the individual cables are specified in each system. All electrical conductors are intended to be copper unless indicated otherwise in the system.

When the penetrating item is indicated as being pipe, the pipe is intended for the transport of gases, liquids and the like. The maximum diameter, the minimum wall thickness and the specific material for conduit and pipes are specified in each system. All nonmetallic pipe is intended to be of the solid-core type unless indicated otherwise in the system.

Further specifications for the various types of penetrating items may be found in the documents referenced below:

Penetrating Item	Document
Electrical metallic tubing (EMT)	ANSI/UL 797
Intermediate metal conduit (IMC)	ANSI/UL 1242
Rigid metal conduit	ANSI/UL 6
Copper tubing	ASTM B88
Copper pipe	ASTM B42
Flexible metal conduit	ANSI/UL 1
Liquid-tight flexible nonmetallic conduit	ANSI/UL 1660
Rigid nonmetallic PVC conduit	ANSI/UL 651
Electrical nonmetallic tubing (ENT)	ANSI/UL 1653
Cross-linked polyethylene (PEX) tubing	ANSI/ASTM D2737
Solid-core polyvinyl chloride (PVC) pipe	ANSI/ASTM D1785 and ANSI/ASTM D2665
Cellular-core polyvinyl chloride (PVC) pipe	ANSI/ASTM F891
Chlorinated polyvinyl chloride (CPVC) pipe	ANSI/ASTM F442
Solid-core acrylonitrile butadiene styrene (ABS) pipe	ANSI/ASTM D1527 and ANSI/ASTM D2661

Cellular-core acrylonitrile butadiene styrene (ABS) pipe	ANSI/ASTM F628
Polybutylene (PB) pipe	ASTM D3000
Polyvinylidene fluoride (PVDF) pipe	ANSI/ASTM F1673
Fiberglass pipe	ANSI/ASTM D2997

Where the individual system specifies the penetrating item is to be rigidly supported on both sides of wall or floor, the support system should be designed based upon the premise the firestop system provides no support.

Where the penetrating item in the individual design is indicated as a metallic pipe, conduit, tube, duct or cable, and the firestop system consists at minimum of a fill material (such as sealants, putty or mortar), the penetrant may pass through the opening in the wall or floor assembly at any angle, provided the annular space is maintained on both sides of the wall or floor assembly and all other specifications in the design are satisfied. In all other cases, except where otherwise indicated in the system, the penetrating item should penetrate the wall or floor assembly at a 90° angle.

Some systems do not include penetrating items. These firestop systems are intended to be used to seal openings where the penetrating items have been removed or where the penetrating items have not yet been installed.

FORMING MATERIALS

Forming materials specified for a firestop system should not be removed after cure of the fill material, unless removal is specified in the description of the system.

The installation contractor and Authority Having Jurisdiction should ensure the specified properties of the packing and/or forming material are satisfied as noted in the individual Classifications. Such properties may include material type (mineral wool, backer rod, fiberglass, etc.), physical properties (size, density, etc.) and installation (depth, orientation, compression, etc.). Attention should also be given to ensure the installed material matches the manufacturer (where applicable) in the individual Classifications. The material and attributes are critical to the performance of the system and the ability of such system to satisfy the conditions of acceptance in [ANSI/UL 1479](#) and the local building code. The fire-resistance rating of the system is dependent upon the use and installation of the materials specified within the respective system.

FILL MATERIALS

When more than one fill, void or cavity material is specified under a single item number within a firestop system, it is intended that any single one of the materials may be used.

CONDUCTOR AMPACITY

Where indicated in the system, the ampacity reduction due to the firestop system has been determined in accordance with [UL Subject 1712](#), "Outline of Investigation for Tests for Ampacity of Insulated Electrical Conductors Installed in Fire Protective Systems." If not specified in the individual system, the effect of the firestop system on the ampacity of electrical conductors has not been investigated.

NUMBERING SYSTEM

The systems are identified in this category by an alpha-numeric identification system. The alpha components identify the type of assembly being penetrated and the numeric component identifies the type of penetrating item.

The first alpha component is an F, W or C. The F signifies a floor is being penetrated, the W signifies a wall is being penetrated, and C signifies either a floor or a wall is being penetrated.

The second alpha component may be any letter. The significance of the letter used is:

Letter	Description
A	Concrete floors with a minimum thickness less than or equal to 5 in.
B	Concrete floors with a minimum thickness greater than 5 in.
C	Framed floors
D	Steel decks in marine vessels
E	Floor-ceiling assemblies consisting of concrete with membrane protection
F through I	Not used at present time
J	Concrete or masonry walls with a minimum thickness less than or equal to 8 in.

K	Concrete or masonry walls with a minimum thickness greater than 8 in.
L	Framed walls
M	Bulkheads in marine vessels
N	Composite panel walls
O through Z	Not used at present time

The numeric component uses sequential numbers to identify the penetrating item. The significance of the number used is:

No. Range	Description
0000-0999	No penetrating items
1000-1999	Metallic pipe, conduit or tubing
2000-2999	Nonmetallic pipe, conduit or tubing
3000-3999	Electrical cable
4000-4999	Cable trays with electrical cable
5000-5999	Insulated pipe
6000-6999	Miscellaneous electrical penetrants, such as busducts
7000-7999	Miscellaneous mechanical penetrants, such as air ducts
8000-8999	Groupings of penetrations, including any combination of items listed above
9000-9999	Not used at present time

ADDITIONAL INFORMATION

For additional information, see Fire Resistance Ratings ([BXRH](#)).

REQUIREMENTS

The basic standard used to investigate products in this category is [ANSI/UL 1479](#) (ASTM E814 [2002]), "Fire Tests of Through-Penetration Firestops."

Where indicated in the individual Classifications under Joint Systems ([XHBN](#)) and Fill, Void or Cavity Materials ([XHWW](#)), fill, void or cavity materials have also been investigated to ASTM C1241 (2000), "Standard Test Method for Volume Shrinkage of Latex Sealants During Cure."

UL MARK

Those materials identified by an (*) in the system description text are eligible to be produced under the Follow-Up Service Program of UL. The Classification Mark of UL on the product is the only method provided by UL to identify products manufactured under its Classification and Follow-Up Service.

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